

*Spec A2*

CLAIMS

1        1. An apparatus for providing a virtual volume, the apparatus comprising:  
2              a plurality of disks;  
3              a back-end controller coupled to the disks for organizing and presenting the  
4              disks as a plurality of redundant arrays of disks; and  
5              a front-end controller coupled to the back-end controller for striping the  
6              redundant arrays of disks and presenting the striped arrays as a virtual volume.

1        2. The apparatus of claim 1 wherein the plurality of disks includes one or  
2              more spare disks.

*Spec B2*

1        3. The apparatus of claim 1 wherein the back-end controller includes a  
2              plurality of busses, each coupled to one and only one of the disks associated with each  
3              of the redundant arrays of disks.

1        4. The apparatus of claim 1 wherein the back-end controller comprises a  
2              RAID engine for presenting the disks as a plurality of RAID sets.

1        5. The apparatus of claim 4 wherein the RAID engine comprises a RAID  
2              engine for presenting the disks as a plurality of RAID-5 sets.

*Spec C3*

1        6. An apparatus for providing a virtual volume, the apparatus comprising:  
2              a plurality of disks;  
3              a RAID engine coupled to the disks for organizing and presenting the disks as  
4              a plurality of RAID sets; and  
5              a striping engine coupled to the RAID engine for receiving the RAID sets as  
6              members, striping the member RAID sets, and presenting the striped RAID sets as a  
7              virtual volume.

1        7. The apparatus of claim 6 wherein the RAID engine comprises a  
2              RAID-5 engine.

*SUB B3*

8. An apparatus for providing a virtual volume, the apparatus comprising:  
a plurality of back-end controllers, each configured to organize and present X  
3 N-member RAID sets, and each having N busses capable of supporting X+1 disks  
4 each;  
5 a plurality of groups of X+1 disks, each group being coupled to one of the  
6 back-end controller busses; and  
7 a local front-end controller coupled to the back-end controllers for receiving  
8 the RAID sets as members, striping the member RAID sets, and presenting the striped  
9 RAID sets as a virtual volume.

1 9. The apparatus of claim 8 wherein the local front-end controller is  
2 configured to generate mirror sets from the RAID sets received as members from  
3 different back-end controllers, to stripe the mirror sets, and to present the striped  
4 mirror sets as the virtual volume.

1 10. The apparatus of claim 8 wherein the plurality of back-end controllers  
2 includes primary local, redundant local, cloning, primary remote, and redundant  
3 remote back-end controllers.

*B3X*

1 11. The apparatus of claim 8 further comprising a remote front-end  
2 controller coupled to at least some of the back-end controllers for receiving RAID sets  
3 as members, striping the member RAID sets, and presenting the striped RAID sets as  
4 the virtual volume.

1 12. The apparatus of claim 11 wherein the remote front-end controller is  
2 configured to generate mirror sets from the received RAID sets, to stripe the mirror  
3 sets, and to present the striped mirror sets as the virtual volume.

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13. An electronic system comprising:  
a computer; and  
an apparatus coupled to the computer for presenting a virtual volume to the  
computer, the apparatus including:  
a plurality of disks;  
a back-end controller coupled to the disks for organizing and  
presenting the disks as a plurality of redundant arrays of disks; and  
a front-end controller coupled to the back-end controller for striping  
the redundant arrays of disks and presenting the striped arrays as the virtual volume.

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14. A method of storing data on a plurality of disks, the method  
comprising:

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organizing the disks into a plurality of redundant arrays of disks;  
striping the redundant arrays of disks together to form a virtual volume; and  
writing the data to the virtual volume.

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15. The method of claim 14 wherein the act of organizing the disks  
comprises organizing the disks into a plurality of RAID sets.

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16. The method of claim 15 wherein the act of organizing the disks  
comprises organizing the disks into a plurality of RAID-5 sets.

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17. The method of claim 14 wherein the act of organizing the disks  
includes:  
providing one or more back-end controllers, each having a plurality of busses;  
and  
coupling the disks to the back-end controller busses so that each bus is coupled  
to no more than one disk from each redundant array of disks and each bus is coupled  
to a spare disk.

1        18. A method of storing data on a plurality of disks, the method  
2 comprising:

3                 organizing the disks into a plurality of redundant arrays of disks;  
4                 forming mirror sets from the redundant arrays of disks;  
5                 striping the mirror sets together to form a virtual volume; and  
6                 writing the data to the virtual volume.

1        19. The method of claim 18 wherein the act of organizing the disks  
2 comprises organizing the disks into a plurality of RAID sets.

1        20. The method of claim 19 wherein the act of organizing the disks  
2 comprises organizing the disks into a plurality of RAID-5 sets.

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